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Research article

PUBLIC HEALTH EFFECTS FROM VEHICULAR EMISSIONS IN KADUNA METROPOLIS, KADUNA STATE, NIGERIA.

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Abstract

Kaduna Metropolis is suffering from poor air quality, mostly because of vehicular emissions or fumes. In fact, it is an indisputable fact that more motor vehicles are going to take the roads of the metropolis as the population grows with the ownership of vechiles. Air pollution caused by existing vehicle emission is known to have already contributed to an increase in asthma, acute respiratory diseases and even sometimes resulted in death . This study aims at assessing the effects public health relating to vehicular emissions in Kaduna Metropolis. Primary data was collected using questionnaires and oral interviews on the trend of vehicle ownership between 2006 to 2011 from Kaduna State Board Internal Revenue, reported cases of traffic related air pollution diseases between 2006 to 2011 from three selected hospitals in the metroplis as well as responses of the inhabintants of the study area on the research subject. Data was analyzed using descriptive analysis. Product Moment Pearson Correlation was used to establish the relationship between motor vehicle emission and its effect on public health. Recommendation were made to reduce vehicular emission in the study area.

Key Words: Vehicle Emission, Public Health, Traffic Related Air Pollution Diseases, Vehicle Ownership,

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INTRODUCTION

Kaduna Metropolis is growing rapidly in demography and motor vehicle ownership. Dependency of urban population on motor vehicles for transportation, particularly those that use fossil fuels to propel their engines, is quite high. The increase automobiles or cars in the streets of Kaduna Metropolis is generating huge traffic jams. Traffic congestion resulting from these transportation systems contributes to the deterioration of the environment in urban communities. In the last few years, the ambient-air quality degradation in the Kaduna Metropolis has been affected by these motor vehicle activities which positively impact economic activities and

negatively generate decreasing ambient air quality and poor public air and health quality that affects pedestrian and local communities.
It has long been recognized that poor ambient air quality has an adverse effect on public health. Within the last decade, data and methods have become available which allow for the quantification of adverse health effects associated with exposure to air pollution. It is apparent that such degradation of air quality could affect public health that is still increasing until today.

World Bank (1994) has been predicted air pollution in some cities in Nigeria in 2000 would be as twice worse as in 1990 and nine times worse in 2020. There is an increase in population, together with increase in the number of vehicles on roads. Vehicle emissions significantly pollute air and require control (Karlsson, 2004). One of the leading concerns is the adverse effect on health of polluted air emitted by motor vehicles. Research in recent decades consistently indicates that outdoor air pollution harms health, and the evidence points to air pollution that stems from motor vehicle activities. With increasing concern for air toxics and climate modification caused by exhaust emissions, the need for tighter control increases in importance. There is therefore a great need for studies involving emission factors and impact. In cities such as Jos air pollution has contributed to the problems of public health (Johnson and Hyeladi, 2013). While there are few industrial activities taking place in Kaduna metropolis, vehicular population increase, so ill-maintained vehicle, outdated engine designs, defective road networks and erratic driving patterns and congestion due to mixed and slow moving traffic are all adding to the air pollution.
Most of the vehicles today use internal combustion engines that burn gasoline or other fossil fuels (Prather, 1995). In the process of combustion, a number of gaseous materials and inpurities are generated. These combustion by-products are emitted into the environment as exhaust gases. Among the critical pollutants, are nitrogen oxides, carbon monoxides, sulphur dioxide, lead and particulate matters. Previous studies have linked traffic-related air pollution to asthma exacerbation and respiratory outcomes. In the U.S. and Europe, children living or attending school near truck routes and highways show increased asthma and allergy symptoms hospitalizations, allergic rhinitis, and reduced lung function (Brauer et al. 2002). Traffic-related pollutants have also been associated with asthma development (Gordian et al. 2006).
Incorporating traffic-related air pollution into large-scale epidemiological studies requires model linking traffic and ambient concentrations. Traffic-health relationships have been examined using a number of different traffic indicators, with no consensus on which indictors best capture variability in traffic-related pollution or health outcomes in different settings.
It is worthy to note that, vehicular pollution can not be avoided as the emissions occur at the near ground level where humans breathe. It will continue to remain a threat to environmental health problem which is expected to be on the increase as vehicle ownership level increases in the world. The urban centres are the worst affected areas because they experience high vehicular concentrations. It is now crystal clear that for any nation to enjoy clean ambient air, air quality control measures must be put in place. Despite all these conscious efforts made by government at all levels to improve on the air quality, problem of vehicular emissions and the associated health problem still persist.
The thrust of this study is on vehicular emissions effects on public health of in Kaduna Metropolis, Nigeria.

AIM AND OBJECTIVES

The aim of this study is to assess the public health effects from vehicle emissions in Kaduna Metropolis.
To achieve this aim, the following objectives have been formulated:

(i) To examine the trend of vehicle ownership in Kaduna Metropolis,
(ii) To assess the maintenance attitude of vehicle owners in Kaduna metropolis,
(iii) To determnine the rate of traffic related air pollution diseases in Kaduna metropolis
(iv) To examine the relationship between exposure to vehicular emission and public health.

HYPOTHESIS OF THE STUDY

H_0: There is no significant relationship between vehicle emissions and public health.
H_1: There is significant relationship between vehicle emissions and public health
Figure 1: Map of Nigeria showing Kaduna State

Source: Department of Geography and Planning, University of Jos

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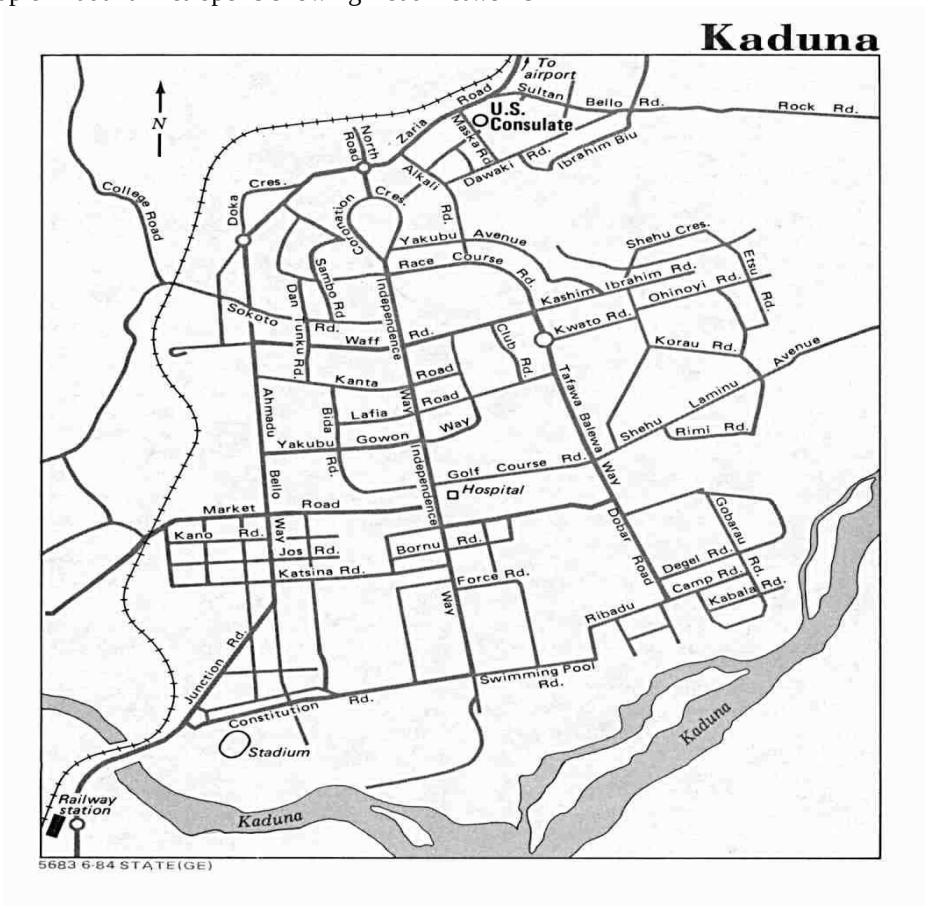
Figure 2: Map of Kaduna Metropolis showing Road Networks



Source: Department of Geography and Planning, University of Jos

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THE STUDY AREA

Kaduna metropolis falls within latitudes 10◦ 22I 00II – 10◦ 26 I 00 II N and longitudes 7◦29 I 00 II – 7◦ 35 I 00 II E with the elevation ranging from 600 to 650m above mean sea level. The approximate size of the study area is 8,000m2 (8km2). It falls within Igabi and Kaduna north local government areas of Kaduna State, Nigeria (Figure 2). Kaduna experiences a tropical continental climate. This type of climate is characterized by two distinct seasons of dry and wet. The dry season sets in October and last till April of the following year while the wet season starts around late April and last till October. Kaduna temperature is high throughout the year with mean minimum temperature at 23°C and mean maximum at about 34°C.The diurnal range of temperature is sometimes as high as 12°C which is good for crop growth throughout the year (Adeleke & Leong, 1981). The annual average rainfall is 1250mm with maximum rainfall between July and August.

MATERIALS AND METHODS

Data on the registration of vehicles in the metropolis for five (5) years was obtained from Kaduna State Board of Internal Revenue, to assess the trend of vehicles registration within Kaduna metropolis. The three major Hospitals in the metropolis, namely, Barau Dikko Specialist Hospital (BDSH), St. Geralds Hospital Kakuri (SGHK) and Dantsoho General Hospital Tudun-Wada (DGHT) data were collected to ascertain reported cases of traffic related air pollution diseases. The choice of these respondents was based on the fact that these institutions are strategically located within the metropolis; they are the major hospitals and also believed to have long medical records of traffic related air pollution diseases. Questionnaires were administered to market women, street hawkers, motor vehicle drivers, motor vehicle conductors, traders and, traffic wardens to assess their health status. The questionnaires were administered in places like Ahmadu Bello Way, Station Round About, Yakubu Gowon Way, Independence Way by Kaduna State Secretariat and Kachia Road by Sabon Tasha motor park. These areas were observed to experience high traffic and frequent traffic congestion. The simple random sampling technique was used to administer the questionnaires. Simple correlation Analysis was used to analyze the data The method of data analysis of data collected was correlation analysis (Pearson Correlation) to test the relationship between number of registered vehicles and reported cases of traffic related pollution diseases. Research instrument is included in the SPSS software (Statistical Package for the Social Sciences), which is a computer program for statistical analysis.

Correlation statistics

Correlation is a statistical test used to find out the relationship between two variables; one independent and the other dependent (i.e. x and y), the relationship can be positive or negative. Positive relationship occur when an increase in one variable leads to increase in the other variable, while a negative relationship occur when an increase in one variable leads to decrease in the other, in this light the relationship can be strong, moderate, weak or nonexistent. The coefficient of correlation (r) is given by the formula below.

$$r = \frac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{[n\Sigma X^2 - (\Sigma X)^2][n\Sigma Y^2 - (\Sigma Y)^2]}}$$

RESULTS AND DISCUSSION

Table 1: Vehicle Registration in Kaduna Metropolis; 2006-2011

	VEHICLE TYPE						
YEAR	**CARS**	**BUSES**	**LORRIES**	**TRAILERS**	**P/UP**	**M/CYCLES**	**TOTAL**
2006	1,762	264	78	62	94	1,111	3,371
2007	1,723	302	69	57	81	1,077	3,309
2008	1,810	314	81	59	87	978	3,329
2009	2,756	317	89	71	101	1,002	4,336
2010	2,923	325	92	78	108	1,172	4,698

2011	3,112	348	99	84	111	1,288	5,042
TOTAL	14,086	1,870	508	411	582	6,628	**24,085**

Source: Kaduna State Board of Internal Revenue; 2012

The table above shows the figures of registered vehicles within Kaduna metropolis, within the period of five (5) years, that is from 2006 to 2011. In 2006, the total vehicles registered was 3,371. While in 2011 it was 5,042. The over all total for the five (5) years is 24,085. The figures from the table above shows that there is considerable increase of vehicles ownership within Kaduna Metropolis.

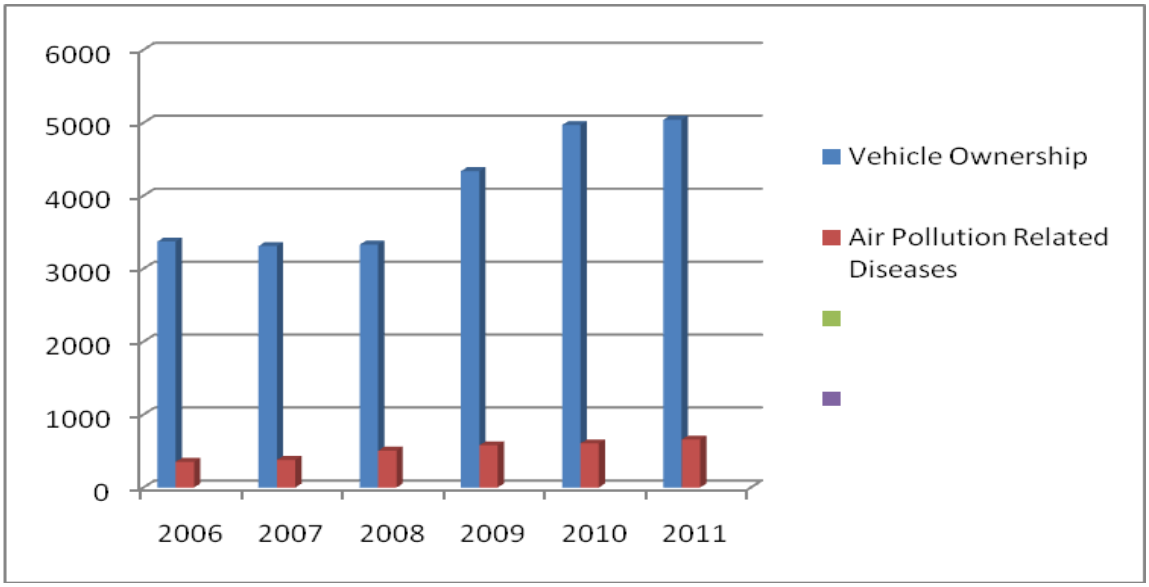
TRAFFIC RELATED AIR POLLUTION DISEASES

Table 2: Traffic Related Air Pollution Diseases: Cases Reported In Three (3) Selected Hospitals in Kaduna Metropolis; 2006-2011

		Diseases			
Year	**Hospital**	**Asthma**	**Cardiovascular**	**Bronchitis**	**Total**
2006	BDSH	12	30	17	59
	SGHK	13	56	58	127
	DGHT	38	45	83	166
	TOTAL	63	131	158	**352**
2007	BDSH	23	65	22	110
	SGHK	14	87	31	132
	DGHT	16	69	51	136
	TOTAL	53	221	104	**378**
2008	BDSH	63	74	50	187
	SGHK	22	55	65	142
	DGHT	38	77	61	176
	TOTAL	123	206	176	**505**
2009	BDSH	68	76	55	199
	SGHK	70	73	52	195
	DGHT	40	75	68	183
	TOTAL	178	224	175	**577**
2010	BDSH	71	75	58	204
	SGHK	72	78	61	211
	DGHT	45	78	66	189
	TOTAL	188	231	185	**604**
2011	BDSH	77	79	62	218
	SGHK	81	76	68	225
	DGHT	54	85	75	214
	TOTAL	212	240	205	**657**
	GRAND TOTAL				**3073**

Source: Medical Records Departments of BDSH, SGHK, DGHT, 2012
Note: Analysis can be made beyond the content of the table above, because not all cases of air polluton related diseases were reported to the Hospital.

Figure 1: SHOWS THE RELATIONSHIP BETWEEN VEHICLE OWNERSHIP AND AIR POLLUTION RELATED DISEASES IN THE STUDY AREA.



Source: Computed from tables 1 and 2

Calculated t value = 0.5215
Critical t value at 0.05% significance at 4 degree of freedom is = 2.78
Critical t value at 0.01% significance at 4 degree of freedom is = 4.60
Conclusion: In order to reject the null hypothesis, the computed value must be larger than the table value under a specified level of significance or degree of freedom. Hence the calculated t value is greater than the critical values at both 0.05% and 0.01% significance levels, it falls in the rejection zone. The study will accept the alternative hypothesis (H_1) which states that there is significant relationship between vehicle emissions and public health.
The results of findings show that the majority of the populace report at least one symptom or the other. The high prevalence for many of the reported symptoms implies that the general health status of the people is poor and may be related to exposure to emissions.
The hypothetical test revealed that there is a significant relationship between vehicle emissions and human health. Analysis of the effects of these emissions to their socio-economic activities reveal that traffic related air pollution diseases affects their attendance to work and also those admitted in the Hospitals spend their resources to maintain their health. It some- times results to deaths.

CONCLUSION

The study reveals that traffic related pollution in Kaduna Metropolis is significant with possibly severe health consequences, especially for people living in areas or in locations close to busy roads. If allowed to continue, it is likely that air quality will only deteriorate as the city continues to grow. The resultant health care and lost productivity costs are very high, especially now that there is influx vehicle and high traffic build-up within the metropolis. The adoption of rigorous regulations and implementation of transport-policies will lead to an uptake of clean air and play a very significant role in reducing air pollution and its consequential harm to the community and the national economy.

RECOMMENDATIONS

Based on the results and findings of this research work, the following recommendations are put forward. Government should improve and control traffic flow. This requires that good city road net-works are built and proper education of motorists on the importance of observing traffic signs are carried out.
Government should make funds available for research and development efforts that can improve fuel economy and engine efficiency, broaden the diversity of available vehicle fuels, and diminish dependence on petroleum while helping to reduce the amount of harmful vehicle emissions released into the air. These can be achieved by,

- Alternative, non-petroleum-based fuels,

• Improved combustion processes;

Government should adopt more stringent vehicle import requirements and enforce rules relating to imported vehicles' age. Government should encourage programmes that will create awareness on the effects of long idling period of vehicles on highways and city streets in order to reduce vehicular emissions;

Government should encourage tree planting as it will help in reducing the amount of carbon in the atmosphere because trees use it during the process of photosynthesis. And finally, with proper implementation of these recommendations there is a high potential for emission reduction and related health hazards.

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